

MAP GUIDE

Global Coastline v1 (ISciences)

Summary

What is it? *Global Coastline v1* is a global map at 1 arc-second of resolution (approximately 30 meters at the equator) defining which areas of the earth are land and which are ocean or sea. Actual extent is S60 to N90. Clearly, any coastline definition is somewhat arbitrary with regards to tide lines and the distance the coastline extends up an estuary. The same thing applies to mud flats and islands that come or go as coastal rivers shift course. Some islands or reefs may not be included due to both the tide issue and minimum feature size. *Global Coastline v1* dataset contains a 1km map (30 arc second), a 90 meter map (3 arc second), and a 30 meter map (1 arc second). All files contain the same coastline definition as both a map mask (ESRI shapefile polygons) and as a map outline (line-based vector data layer).

What is the source of this map? The dataset was produced by ISCIENCES, L.L.C., Ann Arbor, Michigan (ISciences) using USGS SRTM *Water Body Data*, with numerous corrections, for most of the world. NOAA *World Vector Shoreline* data was used for areas above 60 degrees north, which was outside of the SRTM coverage area. In addition, limited data from NGA *Global Shoreline* was used.

Why was this map created? Existing coastline datasets tend to be either too coarse in scale, have serious registration differences when used with high resolution raster datasets such as SRTM or Landsat data, or are incomplete. ISciences developed this dataset to provide a global land/sea mask that closely matches modern high-resolution raster datasets. *Global Coastline v1* has the advantage of high resolution, excellent co-registration, and is complete, without gaps due to data voids.

How was this map constructed? To build *Global Coastline v1* ISciences began with SRTM *Water Body Data* from USGS. The SRTM *Water Body Data* files are a by-product of the data editing performed by the National Geospatial-Intelligence Agency (NGA) to produce the finished SRTM Digital Terrain Elevation Data Level 2 (DTED® 2). The *Water Body Data* is at 1 arc second of resolution. *Water Body Data* only exists between latitudes 60 degrees south and 60 degrees north. It is important to note that *Water Body Data* was not intended as a coastline definition. It defines instead where the sensed elevation values were discarded and the pixels within that area set to a constant elevation data. This replacement of the sensed values occurred for both inland (lakes and rivers) and ocean areas, with one of the fields within the shapefile database indicating for each polygon whether it is a lake, river, or ocean. The key factor that prevents ocean polygons from being an acceptable coastline definition is that voids within the SRTM data were not filled in. Therefore, when sensed elevation values were being replaced with a fixed value of zero (sea level for ocean areas), voids were left untouched. Where these voids extend out from a coast, the resulting polygon showing where the elevation values were replaced traces the outline of the void. Much of the processing ISciences did on this dataset was replacing traced void extents with the correct coastline.

ISciences also redefined a number of lake and river polygons to be ocean so that the shoreline extended somewhat up estuaries, and that the Black and Azov seas were considered ocean rather than as inland lakes. And finally, ISciences added about a half dozen 1 degree tiles within the SRTM coverage area where land existed but no SRTM data did. Altogether, over 350 of the 3755 1x1 degree tiles that define the coastline between S60 to N60 were reworked.

To complete the coverage results from the NOAA Shoreline Project (1:250,000), whose basis was the NOAA World Vector Shoreline data, were incorporated. The NOAA Shoreline Project reworked World Vector Shoreline data, converting it into a single shape file, and then into polygons. This reworked data was in Mercator projection, which ISciences re-projected back into Geographic and used for areas above 60 degrees north, an area not included in SRTM Water Body Data. ISciences elected not to define coastline below 60 degrees south. Future updates to ISciences' *Global Coastline* dataset may include a coastline definition for this area.

NGA *Global Shoreline* (1:75,000) data was used to correct for voids in SRTM data. NGA *Global Shoreline* is a work in progress, and is a replacement for *World Vector Shoreline*. As a prototype, this dataset is not complete, and the vectors that define the coast have gaps between them where the coastline is undefined. This dataset differs from SRTM *Water Body Data* in that *Global Shoreline* defines the coast at the high water mark. As a result, it differs considerably in wetlands and mangroves. *Global Coastline v1* from ISciences generally treats mangroves as land, while NGA prototype *Global Shoreline* treats them as water. Both NGA prototype *Global Shoreline* and ISciences' *Global Coastline v1* have been georeferenced against LandSat images.

The positional accuracy of the dataset varies somewhat with latitude. Between 60 degrees South and 60 degrees North, the primary source, as mentioned above, was the SRTM *Water Body Data*, whose positional accuracy tracked SRTM DTED 2 (20 m circular horizontal, 16 meter horizontal error vertical, both with 90% confidence). Above 60 degrees North, the data was primarily derived from *World Vector Shoreline*, which has an accuracy (90% confidence) of 500 meters. However, the southern limit of our usage from this dataset (at 60 degrees North) was re-georeferenced to match the SRTM data, and then a warping function was applied to blend these new reference into the data further north. So the transition from the 20 meter circular error to the 500 meter circular error is not a step at 60 degrees north, but is instead a gradual transition over a few degrees.

The process of defining a global coastline is ongoing, and new versions will be made available as better sources are identified and acquired.

Using This Map

Global Coastline v1 exists in two formats: closed polygons, whose interior represents land and exterior represents ocean, and as line vectors that trace the land/ocean boundary but do not close on themselves. The actual vertices that define the position of the coast are identical in both formats. The polygons can be used to create a land/water mask for analytical purposes, while the line vectors can be used as an overlay on other imagery to enhance visual presentation and image interpretation.

For both formats, the higher resolution datasets have been broken into 5 x 5 degree tiles. This tiling is performed to limit the number of vertices in any individual polygon or line shape, which would have exceeded 7 million for the largest landmasses in both the Eastern and Western hemispheres. Since the polygons are closed, this tiling results in interior lines along the 5 degree boundaries. A shape identification number has been added to each polygon or line segment to allow the sub-sets of the tiles to be joined together, removing the interior lines. All of the shapes that are part of the same landmass will have a common identification number. To combine the shapes, select the sub-set of 5 degree tiles that cover the area that you're interested in, and then dissolve these shapes on the attribute "ID."

References

National Geospatial Intelligence Agency (formerly National Imagery and Mapping Agency, US Defense Mapping Agency). Prototype Global Shoreline Data (Satellite Derived High Water Line Data). NGA Office of Global Navigation, Maritime Division. <http://www.nga.mil/portal/site/nga01/index.jsp?epi-content=GENERIC&itemID=9328fbd8dcc4a010VgnVCMServer3c02010aRCRD&beanID=1629630080&viewID=Article>

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World Vector Shoreline data
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Data Citation

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